

What is claimed is:

1. A display device comprising:
  - a pixel array having a plurality of pixels arranged two-dimensionally along a first direction and a second direction, each of the plurality of pixels includes a pair of electrodes applying a voltage to liquid crystals, respective groups of the plurality of pixels arranged along the first direction form a plurality of pixel-rows juxtaposed along the second direction, and respective groups of the plurality of pixels arranged along the second direction form a plurality of pixel-columns juxtaposed along the first direction;
  - a scanning driver circuit selecting the plurality of pixel-rows by outputting scanning signals;
  - a data driver circuit outputting a display signals to each of the plurality of pixel-columns and applying the display signal to each of the pixels belonging to any one of the plurality of pixel-columns and at least one of the plurality of pixel-rows selected by the scanning signal; and
- 15 a display control circuit controlling display operation of the pixel array,
  - one line of image data is inputted to the data driver circuit for every vertical scanning period of the image data,
  - the data driver circuit repeats
    - a first step for generating a first display signal corresponding to respective one of the lines of the image data one after another and outputting the first display signals N-times (N is a natural number equal to or greater than 2) to each of the plurality of pixel-columns, and
    - a second step for generating a second display signal (a blanking signal)making brightness of the pixel thereby equal to or darker than that before the second display is applied and outputting the second display signals M-times (M is a natural number smaller than the N) to each of the plurality of pixel-columns, alternately,

- the scanning driver circuit repeats
- a first selection step for selecting every Y rows (Y is a natural number smaller than the N/M) of the plurality of pixel-rows in response to every one of the N-times outputs of the first display signals in the first step sequentially from one end of the pixel array to another end of the along the pixel array along the second direction, and
- 5 a second selection step for selecting every Z rows (Z is a natural number not smaller than the N/M) of the plurality of pixel-rows other than those selected in the first selection step in response to every one of the M-times outputs of the second display signals in the second step sequentially from the one end to the another end of the pixel array along the second direction, alternately,
- 10 a polarity of one of the pair of electrodes provided for each of the plurality of pixels against another thereof is
- different from one another among ones of the plurality of pixels adjacent to one another along at least one of the first direction and the second direction by the first signals applied thereto during the first step, and
- 15 different from each other between one of the plurality of pixels selected in the second selection step and another of the plurality of pixels selected subsequently to the second selection step by the second signals applied to the one of the plurality of pixels wherever the one and the another of the plurality of pixels belong to the same one of the plurality of pixel-columns.
- 20 2. A display device according to claim 1, wherein
- the scanning driver circuit starts to output the scanning signals for every frame period of the image data, and
- an output timing of the second display signal in the second step against the start 25 of the scanning signal output during one of the frames is different from that during another of the frames subsequently to the one of the frames.

3. A display device according to claim 1, wherein  
the number Y of the respective rows of the plurality of pixel-rows being selected in response to each output of the first display signal is 1, the number N of the first display signal outputs in the first step is equal to or greater than 4, the number Z of the respective rows of the plurality of pixel-rows being selected in response to each output of the second display signal is equal to or greater than 4, and the number N of the second display signal outputs in the second step is equal to 1.
4. A driving method for a display device having a pixel array in which a plurality of pixels are arranged two-dimensionally along a first direction and a second direction,  
each of the plurality of pixels includes a pair of electrodes applying a voltage to liquid crystals, respective groups of the plurality of pixels arranged along the first direction form a plurality of pixel-rows juxtaposed along the second direction, and respective groups of the plurality of pixels arranged along the second direction form a plurality of pixel-columns juxtaposed along the first direction,
- 15 the plurality of pixel-rows are selected respectively in response to every scanning signal,  
the plurality of pixel-columns receive a display signal each, and  
the display signal is applied to one of the pair of electrodes of each of the plurality of pixels belonging to each one of the plurality of pixel-rows selected by the scanning signal while a reference voltage is applied to another of the pair of electrodes provided in the each of the plurality of pixels,
- 20 repeating:  
a first step for selecting every Y rows (Y is a natural number) of the plurality of pixel-rows N-times (N is a natural number equal to or greater than 2) sequentially from one end of the pixel array to another end of the along the pixel array along the second direction, and applying first display signals generated in accordance with every line component of image data which is inputted to the display device sequentially in response

to a vertical synchronizing signal of the image data to the one of the pair of electrodes provided in each of the pixels belonging to the every Y pixel-rows as selected sequentially; and

a second step for selecting every Z rows (Z is a natural number) of the plurality

- 5      of pixel-rows other than those selected during the first step M-times (M is a natural number satisfying relationship of  $M < N$ ,  $Y < N/M \leq Z$ ) sequentially from the one end to the another end, and applying a second display signal to the one of the pair of electrodes provided in each of the pixels belonging to the Z pixel-rows as selected sequentially so that brightness of the Z pixel-rows becomes equal to or lower than that before the second
- 10     display signal is supplied thereto, alternately,

wherein polarity of the first display signals against the reference voltage is different from one another between one of the N-times of the every Y pixel-rows selections and another thereof subsequent to the one thereof, and

the second display signal inputted in the Z pixel-rows selected in the second step has different polarity against the reference voltage from that of the display signal other than the second display signal which is inputted to at least one of the pixel-rows being selected subsequently to the second step in every one of the plurality of pixel-columns.

5.      A driving method for a display device having a pixel array in which a plurality 20 of pixels are arranged two-dimensionally along a first direction and a second direction, each of the plurality of pixels includes a pair of electrodes applying a voltage to liquid crystals, respective groups of the plurality of pixels arranged along the first direction form a plurality of pixel-rows juxtaposed along the second direction, and respective groups of the plurality of pixels arranged along the second direction form a plurality of 25 pixel-columns juxtaposed along the first direction,

the plurality of pixel-rows are selected respectively in response to every scanning signal,

the plurality of pixel-columns receive a display signal each, and  
the display signal is applied to one of the pair of electrodes of each of the  
plurality of pixels belonging to each one of the plurality of pixel-rows selected by the  
scanning signal while a reference voltage is applied to another of the pair of electrodes  
provided in the each of the plurality of pixels,  
repeating:  
a first step for selecting every Y rows (Y is a natural number) of the plurality of  
pixel-rows N-times (N is a natural number equal to or greater than 2) sequentially from  
one end of the pixel array to another end of the along the pixel array along the second  
direction, and applying first display signals generated in accordance with every line  
component of image data which is inputted to the display device sequentially in response  
to a vertical synchronizing signal of the image data to the one of the pair of electrodes  
provided in each of the pixels belonging to the every Y pixel-rows as selected  
sequentially; and  
15 a second step for selecting every Z rows (Z is a natural number) of the plurality  
of pixel-rows other than those selected during the first step M-times (M is a natural  
number satisfying relationship of  $M < N$ ,  $Y < N/M \leq Z$ ) sequentially from the one end to  
the another end, and applying a second display signal to the one of the pair of electrodes  
provided in each of the pixels belonging to the Z pixel-rows as selected sequentially so  
20 that brightness of the Z pixel-rows becomes equal to or lower than that before the second  
display signal is supplied thereto, alternately,  
wherein polarity of the first display signals against the reference voltage is  
different from one another among mutually adjacent columns of the pixel-columns, and  
the second display signal inputted in the Z pixel-rows selected in the second  
25 step has different polarity against the reference voltage from that of the display signal  
other than the second display signal which is inputted to at least one of the pixel-rows  
being selected subsequently to the second step in every one of the plurality of

pixel-columns.

6. A driving method for a display device according to claim 4, wherein  
the image data are inputted to the display device every frame period thereof,  
a selection operation of the plurality of pixel-rows is started for the every frame  
5 period, and

a timing of the second step with respect to the start of the selection operation of  
the plurality of pixel-rows in one of the frames is different from that in another of the  
frames subsequently to the one of the frames.

7. A driving method for a display device according to claim 4, wherein  
10 the first step is performed by setting the number Y of the respective pixel-rows  
selected in response to each output of the first display signal to 1 and the number N of  
the first display signal outputs to not smaller than 4, and

the second step is performed by setting the number Z of the respective  
pixel-rows being selected in response to each output of the second display signal to not  
15 smaller than 4 and the number N of the second display signal outputs to 1.

8. A driving method for a display device according to claim 5, wherein  
the image data are inputted to the display device every frame period thereof,  
a selection operation of the plurality of pixel-rows is started for the every frame  
period, and

20 a timing of the second step with respect to the start of the selection operation of  
the plurality of pixel-rows in one of the frames is different from that in another of the  
frames subsequently to the one of the frames.

9. A driving method for a display device according to claim 5, wherein  
the first step is performed by setting the number Y of the respective pixel-rows  
25 selected in response to each output of the first display signal to 1 and the number N of  
the first display signal outputs to not smaller than 4, and

the second step is performed by setting the number Z of the respective pixel-rows being selected in response to each output of the second display signal to not smaller than 4 and the number N of the second display signal outputs to 1.

10. A display device comprising:

5 a pixel array having a plurality of pixels arranged two-dimensionally along a first direction and a second direction, respective groups of the plurality of pixels arranged along the first direction form a plurality of pixel-rows juxtaposed along the second direction, and respective groups of the plurality of pixels arranged along the second direction form a plurality of pixel-columns juxtaposed along the first direction;

10 a scanning driver circuit selecting the plurality of pixel-rows by outputting scanning signals;

a data driver circuit outputting a display signals to each of the plurality of pixel-columns and applying the display signal to each of the pixels belonging to any one of the plurality of pixel-columns and at least one of the plurality of pixel-rows selected  
15 by the scanning signal; and

a display control circuit controlling display operation of the pixel array,  
wherein one line of image data is inputted to the data driver circuit for every vertical scanning period of the image data;

20 the data driver circuit repeats a first step for performing an operation to generate a first display signal corresponding to respective one of the lines of the image data one after another and to output the first display signals to each of the plurality of pixel-columns in every certain period N-times (N is a natural number equal to or greater than 2), and a second step for performing an operation to generate a second display signal (a blanking signal) making brightness of the pixel thereby equal to or darker than  
25 that before the second display is applied and to output the second display signals to each of the plurality of pixel-columns, alternately in the every certain period M-times (M is a natural number smaller than the N), alternately;

- the scanning driver circuit repeats a first selection step for selecting every Y rows (Y is a natural number smaller than the  $N/M$ ) of the plurality of pixel-rows in response to every one of the N-times outputs of the first display signals in the first step sequentially from one end of the pixel array to another end of the along the pixel array  
5 along the second direction, and a second selection step for selecting every Z rows (Z is a natural number not smaller than the  $N/M$ ) of the plurality of pixel-rows other than those selected in the first selection step in response to every one of the M-times outputs of the second display signals in the second step sequentially from the one end to the another end of the pixel array along the second direction, alternately;
- 10 the scanning driver circuit repeats a selection operation of the plurality of pixel-rows throughout the pixel array during every frame period of the image data;  
a deviation of the certain period of the second step from a starting time of the pixel-rows selection operation throughout the pixel array is different between each one of the frame periods and another of the frame periods subsequent thereto; and  
15 a time difference between the deviation of the certain period of the second step from the starting time of the pixel-rows selection operation in the each one of the frame periods and that in the another of the frame periods subsequent thereto are regulated to be shorter than  $(N-2)$  times as long as the certain period.
11. A display device according to claim 10, wherein  
20 the number Y of the respective rows of the plurality of pixel-rows being selected in response to each output of the first display signal is 1, the number N of the first display signal outputs in the first step is equal to or greater than 4, the number Z of the respective rows of the plurality of pixel-rows being selected in response to each output of the second display signal is equal to or greater than 4, and the number N of the  
25 second display signal outputs in the second step is equal to 1.

12. A display device comprising:

a pixel array having a plurality of pixels arranged two-dimensionally along a first direction and a second direction, respective groups of the plurality of pixels arranged along the first direction form a plurality of pixel-rows juxtaposed along the second direction, and respective groups of the plurality of pixels arranged along the second direction form a plurality of pixel-columns juxtaposed along the first direction;

5        a scanning driver circuit selecting the plurality of pixel-rows by outputting scanning signals;

a data driver circuit outputting a display signals to each of the plurality of 10 pixel-columns and applying the display signal to each of the pixels belonging to any one of the plurality of pixel-columns and at least one of the plurality of pixel-rows selected by the scanning signal; and

15        a display control circuit controlling display operation of the pixel array,

wherein one line of image data is inputted to the data driver circuit for every 15 vertical scanning period of the image data;

the data driver circuit repeats

a first step for performing an operation to generate a first display signal corresponding to respective one of the lines of the image data one after another and to output the first display signals to each of the plurality of pixel-columns N-times (N is a 20 natural number equal to or greater than 2), and

a second step for performing an operation to generate a second display signal (a blanking signal) making brightness of the pixel thereby equal to or darker than that before the second display is applied and to output the second display signals to each of the plurality of pixel-columns, M-times (M is a natural number smaller than the N),

25 alternately;

the scanning driver circuit repeats

a first selection step for selecting every Y rows (Y is a natural number smaller than the N/M) of the plurality of pixel-rows in response to every one of the N-times outputs of the first display signals in the first step sequentially from one end of the pixel array to another end of the along the pixel array along the second direction on a basis of  
5 scanning clock signals inputted to the scanning driver circuit, and

10 a second selection step for selecting every Z rows (Z is a natural number not smaller than the N/M) of the plurality of pixel-rows other than those selected in the first selection step in response to every one of the M-times outputs of the second display signals in the second step sequentially from the one end to the another end of the pixel array along the second direction, alternately; and

15 the scanning driver circuit repeats a selection operation of the plurality of pixel-rows throughout the pixel array during every frame period of the image data and has means for adjusting a number of the scanning clock signals generated between the last output of the second display signals in one of the frame periods and the first output of the second display signals in another of the frame periods subsequent to the one of the frame periods to N while the one of the frame periods is replaced by the another of the frame periods.

13. A display device according to claim 12, wherein

20 the number Y of the respective rows of the plurality of pixel-rows being selected in response to each output of the first display signal is 1,

the number N of the first display signal outputs in the first step is equal to or greater than 4,

the number Z of the respective rows of the plurality of pixel-rows being selected in response to each output of the second display signal is equal to or greater than 4, and

25 the number N of the second display signal outputs in the second step is equal to 1.

14. A driving method for a display device having a pixel array in which a plurality of pixels are arranged two-dimensionally along a first direction and a second direction, respective groups of the plurality of pixels arranged along the first direction form a plurality of pixel-rows juxtaposed along the second direction, and respective groups of the plurality of pixels arranged along the second direction form a plurality of pixel-columns juxtaposed along the first direction,  
5 the plurality of pixel-rows are selected respectively in response to every scanning signal,

the plurality of pixel-columns receive a display signal each and the display signal is supplied to each of the pixels belonging both to the respective pixel-column and to each one of the plurality of pixel-rows selected by the scanning signal,

10 the plurality of pixel-columns receive a display signal each and the display signal is supplied to each of the pixels belonging both to the respective pixel-column and to each one of the plurality of pixel-rows selected by the scanning signal,  
repeating:

15 a first step for selecting every Y rows (Y is a natural number) of the plurality of pixel-rows N-times (N is a natural number equal to or greater than 2) sequentially from one end of the pixel array to another end of the along the pixel array along the second direction in response to scanning clock signals, and applying first display signals generated in accordance with every line component of image data which is inputted to the display device sequentially in response to a vertical synchronizing signal of the image data to the one of the pair of electrodes provided in each of the pixels belonging to  
20 the every Y pixel-rows as selected sequentially; and

a second step for selecting every Z rows (Z is a natural number) of the plurality of pixel-rows other than those selected during the first step M-times (M is a natural number satisfying relationship of  $M < N$ ,  $Y < N/M \leq Z$ ) sequentially from the one end to the another end, and applying second display signal to the one of the pair of electrodes provided in each of the pixels belonging to the Z pixel-rows as selected sequentially so that brightness of the Z pixel-rows becomes equal to or lower than that before the second display signal is supplied thereto, alternately, wherein  
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a number of the scanning clock signals generated between the last output of the second display signals in one of frame periods of the image data and the first output of the second display signals in another of the frame periods subsequent to the one of the frame periods is adjusted to N while the one of the frame periods is replaced by the  
5 another of the frame periods.

15. A driving method for a display device according to claim 14, wherein
- the first step is performed by setting the number Y of the respective pixel-rows selected in response to each output of the first display signal to 1 and the number N of the first display signal outputs to not smaller than 4, and
- 10 the second step is performed by setting the number Z of the respective pixel-rows being selected in response to each output of the second display signal to not smaller than 4 and the number N of the second display signal outputs to 1.